


Radiation Information Evaluated by
the Radiation Effects Subcommittee
of the NSIC of AESJ
in the Fukushima Nuclear Disaster

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The Japanese Nuclear Emergency Response System

- Act on Special Measure Concerning Nuclear Emergency Preparedness.
- Basic Disaster Prevention Plan.(Vol.15)
- Guideline for Protective Actions to Radiological Disasters by Nuclear Accidents (NSC Japan).

Basic Ideas in the Emergency Response System:

1. Quick establishment of initial response organizations.
2. Co-ordination and integration between national and local governments.



Some Difficulties in the Early Stage of Emergency Response to the Nuclear Disaster

- Emergency monitoring system had not worked for long time.
- The information from the SPEEDI system did not utilized for planning protective actions because the necessary information from the plant could not be obtained.
- Failure of the systematic emergency monitoring for planning appropriate protective actions. (spatial distribution, priority, ranking)
- Determination of protective actions was done with having no relation with emergency monitoring information.
- Confusion between dose and dose rate or total amount of intake and concentration of radioactive materials.




Radiation Effects Subcommittee Organized in the Fukushima Nuclear Disaster

Sections of AESJ	Health Physics · Environmental Science, Radiation Engineering, Sociological Environment
Member	I.Urabe, T.Hattori, H.Yamazawa, S.Yokoyama, T.Takahashi, T.Momose, I.Iimoto, T.Iguchi, H.Hirayama, H.Takahashi, M.Uematsu, T.Sanami, H.Nakashima, T.Iwai, M.Morokuzu, T.Mishima, T.Inamura, T.Sawada
Purposes	<ul style="list-style-type: none">· Contribute to decrease reasonably the doses of the public exposed to radioactive materials released from the reactor and the workers engaged in protective action.· Prepare the radiological information which will contribute to investigate the problems raised in the future.· Communicate with the people in the world on the experience of emergency response to radiological disaster



Issues Discussed in this Subcommittee

- Estimation of total amount of radioactive materials released from the reactors.
- Collection, analysis, and evaluation of radiological information based on the monitored data.
- Radiation measuring technique needed under the radiological emergency.
- Management of exposure doses of the public and peoples working for protective action.
- Co-operation of specialists belong to various scientific organizations.
- Release of the finding information to the public or organizations relating to the Fukushima radiological disaster management.



From the Guideline to Environmental Radiation Monitoring (Nu.Sci.Com.)-1

The 1st Stage of Emergency Monitoring

The 1st stage emergency monitoring should be started immediately after the declaration of the nuclear emergency, and it is required to be started as soon as possible and the accuracy of the data is not required as that at the 2nd stage. . . .

1. Evaluation of radiation exposure rates and released radioactive materials (radioactive noble gases, radioactive iodine and uranium or plutonium) in the natural environment around the nuclear facilities.
2. Evaluation of radioactive materials in drinking water, green vegetables, milk and rain water .
3. Expeditious prediction of radiation doses for planning emergency countermeasures against radiological disaster.



From the Guideline to Environmental Radiation Monitoring (Nu.Sci.Com.)-2

The 2nd Stage of Emergency Monitoring

The 2nd stage monitoring should be • • after confirming the slight release of radioactive materials based on the prediction of the accident progression, and it is needed to collect information for evaluation of exposure doses of the public and the effects of environment. • • data should be obtained more accurately than those required at the 1st stage. • • •

1. Detailed assessment of the movement of the released radioactive materials is required for evaluation of radiation doses of the public.
2. Monitoring should be implemented at intervals of several days in wider range of the 1st stage.
3. Monitored data will be used for release of protective measures.



1. Estimation of Radioactive Materials Released from the Reactors (1)

- Total amount of radioactive materials were estimated on the basis of
 1. Monitored data around the site boundary of the nuclear facilities and environmental monitoring data by Fukushima prefecture.
 2. Calculation by the System for Prediction of Environmental Emergency Dose Information (SPEEDI)

$^{131}\text{I}(\text{Bqh}^{-1})$	$^{137}\text{Cs}(\text{Bqh}^{-1})$	period
10^{16}	$\left(\frac{1}{100} \sim 1\right)$ of ^{131}I	A few hours
10^{14}		A few days
$10^{13} \sim 10^{12}$		About 2 weeks

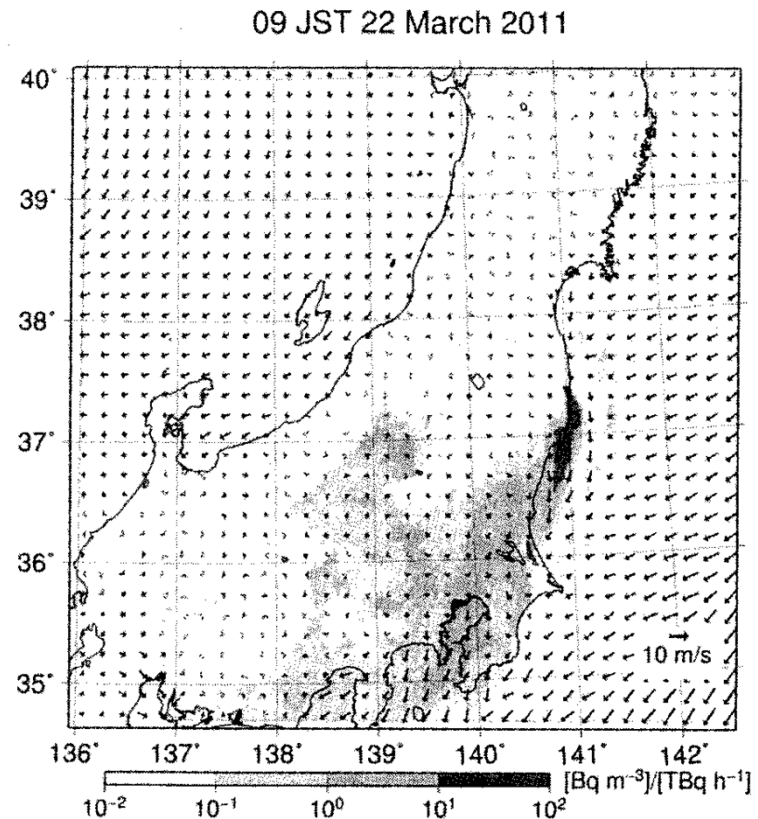
1. Estimation of Radioactive Materials Released from the Reactors (2)

- The atmospheric diffusion of radioactive materials were evaluated

1. Evacuation area (within 20km radius from the plants)

2. The area up to several tens of km northwestward of the nuclear power plants.

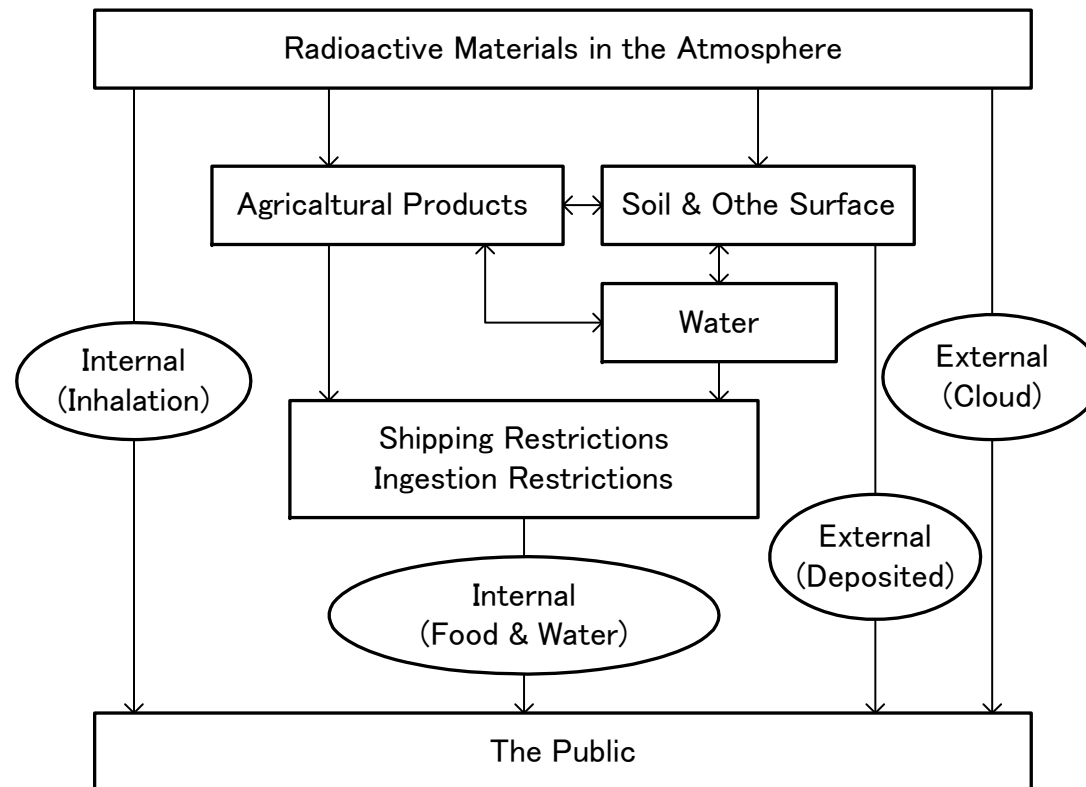
3. Wide spread Area (Fukushima Nakadori, Tohoku and Kanto Districts)



H.Yamazawa and S.Hirao;J.AESJ,53(7) 2011

2. Preparation of the Plane View of Exposure Rate Distribution (1)

- Evaluation of the exposure pathways to the public



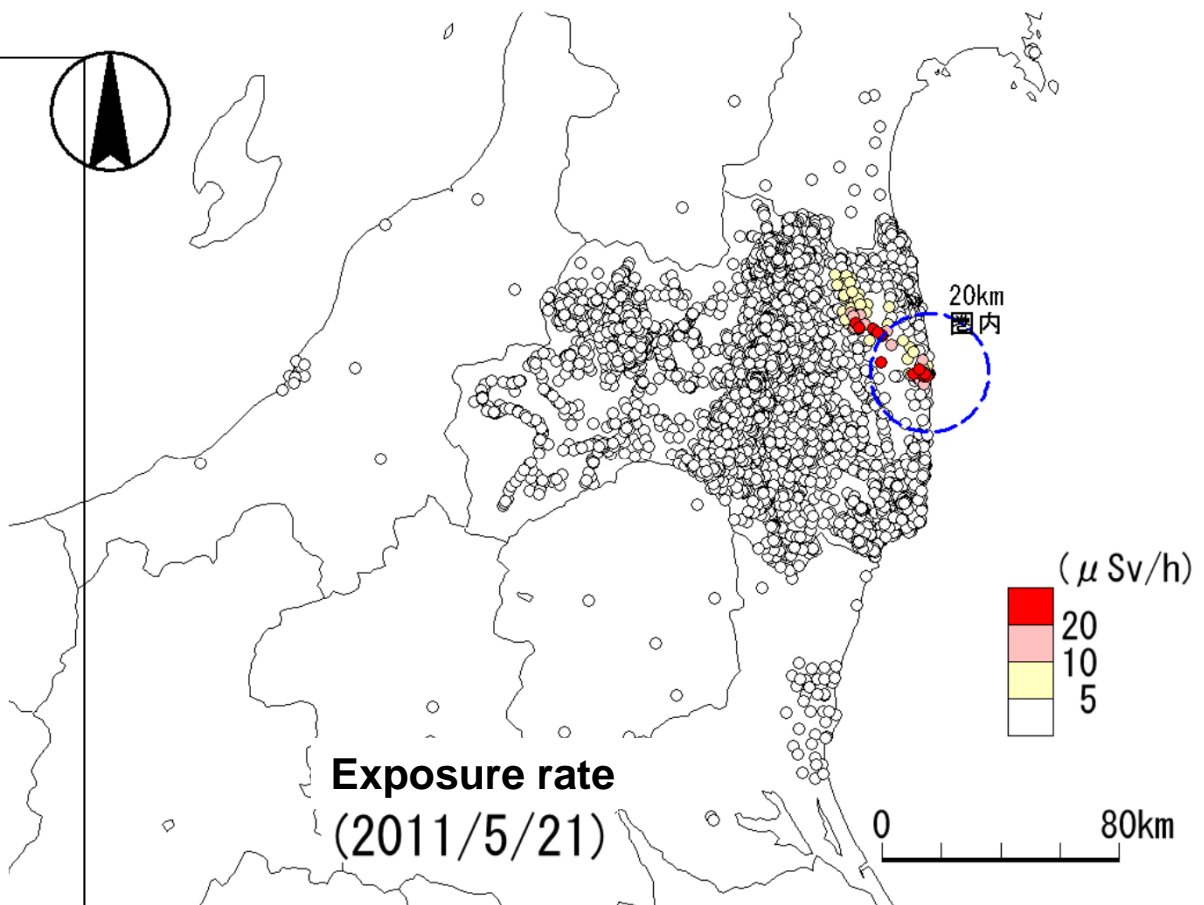
1. Main exposure path way was the external exposure by radioactive materials released to the air or to the sea.
2. Internal exposure by inhaling radioactive materials could not be estimated.

2. Preparation of the Plane View of Exposure Rate Distribution (2)

■ Findings from the plane view of exposure rates

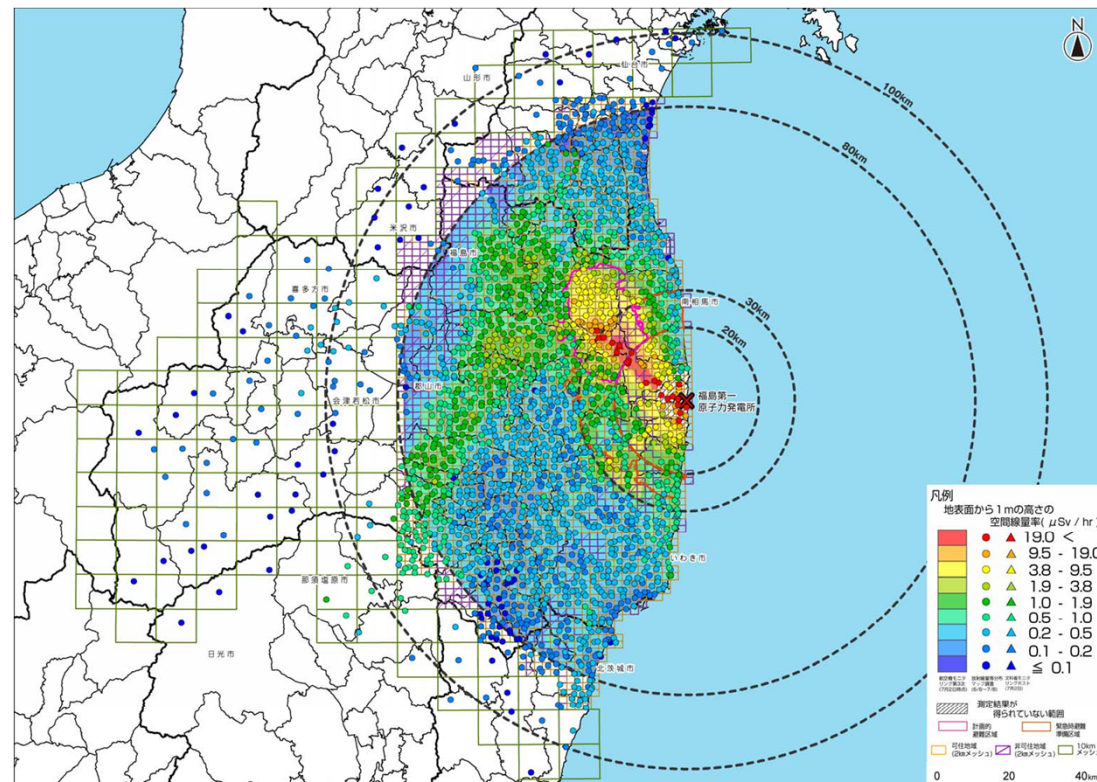
1. Exposure rates more than $20 \mu\text{Sv h}^{-1}$ were observed in the planned relocation area in the northwestward from the nuclear power plants.

2. Exposure rates around $1 \mu\text{Sv h}^{-1} \sim 5 \mu\text{Sv h}^{-1}$ were widely observed and relatively high exposure rates were observed in Naka-dori area of Fukushima prefecture.



2. Preparation of the Plane View of Exposure Rate Distribution (3)

- The analysis procedure employed here was subsequently applied as a methodology for investigation of environmental radiation dose distributions for planning radiological countermeasures.



Exposure rate distribution reported by the MEXT on August 2, 2011



2. Preparation of the Plane View of Exposure Rate Distribution (4)

- Some Notes to be considered in case of announcing radiation information to the public
 1. It is needed to provide detailed explanation not to make inhabitants feel anxiety and not to cause social confusion.
 2. It is very important to prepare discussion among stakeholders on the effects resulting from the announcement of radiation information.



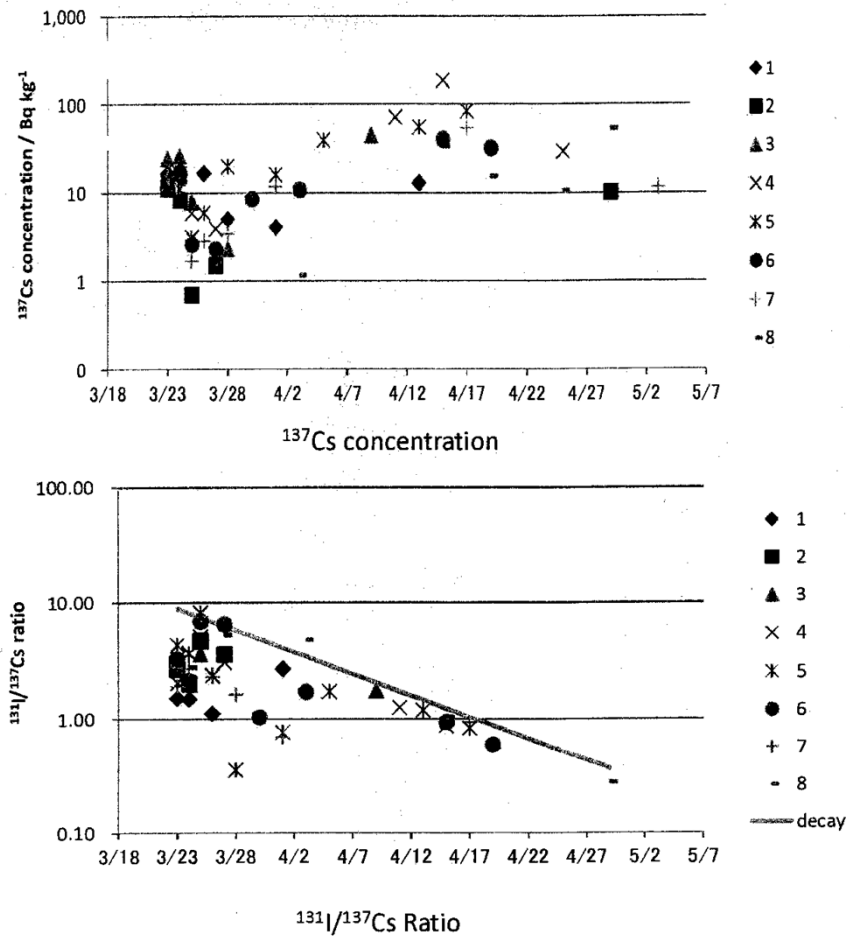
3. Estimation of Radioactive Materials Released to the Sea Area (1)

- Support to radioactivity analysis of seawater and seafood planned by National Nuclear Emergency Preparedness Organization.
- Study on the movements of radioactive materials in the seawater and ocean soil.
 1. The contamination process of the ocean soil and fish was clarified from the movement of radioactive materials estimated by the realistic analysis system using atmosphere-ocean combined model for contamination materials.
 2. Contamination of sea area was significantly caused by some percentage of the radioactive materials released to the air.

3. Estimation of Radioactive Materials Released to the Sea Area (2)

■ Study on the movements of radioactive materials in the seawater and ocean soil.

1. It was clarified from the movement of radioactive materials in the coastal zone of the nuclear power plants that radioactive materials is still releasing from the power plants to the sea.
2. International consensus on the release of radioactive materials toward the sea area will be required in the future.



Reported by D.Tsumune on July 2, 2011



Future Problems

- Understanding of realistic radiological condition of the living environments where the public would live again.
- Communications among stakeholders to choose appropriate countermeasures to reduce radiation doses as low as reasonably achievable.
- Requirements to release from the nuclear and radiological emergency situation.
- Reconstruction of the nuclear emergency preparedness system based on the lessons learned from the countermeasures performed in the early stage of the radiological emergency.
 - **Establishment of network among the organizations as early as possible for planning countermeasures based on the radiation information derived systematically.**
 - **Estimation of radiation doses of the public and the workers engaged in protective actions under the emergency exposure condition.**